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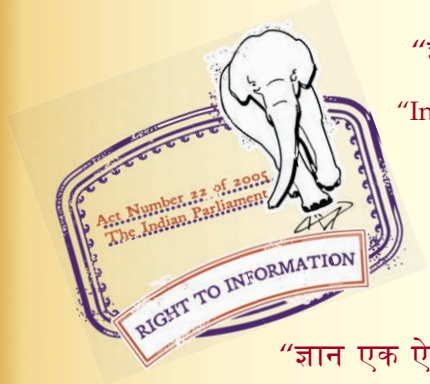
IS 6936 (1992): Guide for location, selection and hydraulic design of canal escapes [WRD 13: Canals and Cross Drainage Works]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 6936 : 1992
(Reaffirmed 2012)

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नहर निकास के लिए स्थान, चुनाव एवं जलीय डिजाइन की मार्गदर्शिका

(पहला पुनरीक्षण)

Indian Standard

GUIDE FOR LOCATION, SELECTION AND HYDRAULIC DESIGN OF CANAL ESCAPES

(First Revision)

UDC 626·422·45

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 1992

Price Group 2

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Canals and Canal Linings Sectional Committee had been approved by the River Valley Division Council.

Escapes are essentially sefety valves for the canal system. They can serve such purposes as protection of the canal against possible damage, emptying of the canal for repairs and maintenance in addition to removing a part of sediment deposited in the canal.

Though the admission of water into the canal from the head is under complete control by the provision of a head regulator excess rise in water level, may take place at any point on the canal downstream as a result of admission of storm water into the system or due to sudden reduction in demand. The closure of canal outlets by the farmers due to low demand or faulty regulation, could increase water level which may make the canal banks vulnerable to breaches or dangerous leaks. Similar situations can also arise in the case of lift canals in the event of breakdown in the water lifting arrangements. Provision of surplus escapes at suitable intervals along the canal would control the water levels and thereby save the canal from being damaged by qutflanking or breaching.

At times, the canal may be required to be closed for carrying out repair works, weed clearance, etc. Provision of escapes would enable the canal to be drained quickly thereby facilitating expeditious clearing and repair operations.

In some cases the head reach of a main canal may be subjected to heavy siltation. This would necessitate provision of scouring sluice in the form of an escape structure to clear the silt deposit.

Indian Standard

GUIDE FOR LOCATION, SELECTION AND HYDRAULIC DESIGN OF CANAL ESCAPES

(First Revision)

1 SCOPE

1.1 This standard covers the requirements of setting of escape structures on an irrigation canal system, selection of the type of structure and hydraulic design considerations.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Tilte*
4997 : 1968	Criteria for design of hydraulic jump type stilling basins with horizontal and sloping apron
6531 : 1992	Criteria for design of canal head regulators (*first revision*)

3 TERMINOLOGY

3.0 For the purpose of this standard the following definition shall apply.

3.1 Canal Escape

A structure to escape surplus or excess water from the canal.

4 CLASSIFICATION OF ESCAPES

4.1 Types of Escape

The escapes may be classified into the following types:

a) *Weir or Surface Escapes* — These are weirs or flush escapes constructed either in masonry or concrete with or without crest shuters which are capable of disposing surplus water from the canal.

b) *Sluice Escape* — Sluices are also used as surplusing escapes. They enable the canal to be emptied quickly for repairs and maintenance and in some cases act as scouring sluices also, to facilitate removal of silt.

5 LOCATION OF ESCAPES

5.1 Escapes should be located at suitable intervals and places as detailed in **5.2** to **5.9**.

5.2 Location of canal escapes are often determined on the availability of suitable drains, depressions or rivers with their bed level at or below canal bed level for disposing surplus water through the escapes, directly or through an escape channel.

5.3 Escapes may be necessary near important points where branches take off from a main canal or several distributries take off from a branch. In case of lift channels escapes are essential on upstream of the pumping stations. Also in case of power channels, escapes may be necessary upstream of balancing reservoirs and forebays.

5.4 Wherever a canal is very close to the edge of the river bank, its bed level near the headworks being considerably lower than the flood plain of the river there is a risk of flood flow entering into the canal by way of breaches. If there is no escape provision the canal system may be seriously damaged by excessive flow. Escapes may be located at a point downstream of the reach where the canal bank is vulnerable to river flood damage, to restrict the damage to the reach upstream of the escape only.

5.5 When the canal runs along a steep side hill or along a steep bank of comparatively soft material, an escape may be located at the upstream end of the canal section where it first approaches the steep bank. In case of a land slide occurring in the hill slope the entire canal may be blocked resulting in abrupt rise in water level on the upstream for a considerable distance. This in turn can cause extensive damage to the canal section. An escape provided at a suitable place on the upstream of such a reach would act as a safety plug to arrest the rise in water level and avoid consequential effects. Where the length of such vulnerable sections are large intermediate escapes may also be necessary.

5.6 Escapes opposite the inlets or at nearest suitable location may be needed whose drainage water is let into the canal without reserve capacity to receive such water over and above the authorized discharge of the canal.

5.7 Certain quantity of heavy bed silt may find its way through the head regulator into the head reach of the main canal and thereby reduce the water way. In such cases, sluice escape within 5 km of the canal head reach is a useful adjunct. The sluice escape if properly worked will assist in keeping down the bed level of the head reach of the canal. Such escapes can also work as silt ejector for diversion schemes.

5.8 Where the canal is confined by bank on one side only and the unbanked side allows surface inflow, escapes need to be provided at appropriate location in the vicinity, to dispose of the water so received.

5.9 Provision of an escape on up stream of railway crossing and in the initial reach of canal, upstream of major aqueducts tunnel is desirable at suitable locations.

5.10 Provision of an escape at certain distance is desirable. For the main canal escape at 15 to 20 km and for other canals 10 to 15 km may be provided.

6 CHOICE OF THE TYPE OF ESCAPE

6.0 The choice of the type of escape should be made considering the requirements of that particular escape which will be different for different escapes.

6.1 Surface Escape

Such structures may be conveniently used in case of an escape opposite an inlet when the inlet does not bring in considerable quantity of silt. Surface escape also become useful at the tail end of the canal or on, lift irrigation schemes, when there is fluctuation in the withdrawals from the canal excess quantities of flow may be conveniently diverted through the surface escape.

6.2 Sluice Escape

These escapes are necessary wherever the canal is required to be emptied quickly. Sluice escapes become essential opposite an inlet when the inlet can bring in considerable quantity of silt. Sluice escapes in such cases would serve the following purposes.

a) Removal of the surplus water, and

b) Exclusion of silt.

6.3 Sometimes surface escapes may be provided in combination with sluice escapes to serve the required purpose. The sluices may be provided in the body walls of the weirs with the top of shutters at full supply level.

6.4 Escapes may sometimes be provided economically in combination with canal aqueducts/ syphon.

7 CAPACITY OF ESCAPES

7.1 Flows required to be diverted through the escapes may vary from small quantities to total canal discharges.

7.2 No general rule may be laid for the discharge capacity of each escape. At important locations like canal passing cities or towns where breach of canal can effect costly properties or human life, the discharging capacity of escape should equal the maximum flows that may occur in the canals. Escape capacity may include flood run-off as well where inlets are provided for entry of flood waters. At locations where the entire flow is to be escaped cross regulators would be necessary. In other cases it should seldom be greater than half the maximum discharge of the canal or not less than the difference between the maximum discharge of the canal at the site of the work and maximum flow at the next lower escape.

7.3 In case of escapes located in the vicinity of inlets the minimum discharge capacity will be fixed by that of the inlet, but it may occasionally be designed for a greater capacity to enable it to dispose of excess water brought by the canal.

7.4 Capacity of the sluice escape which acts as a scouring sluice at the head reach of the main canal to facilitate scouring of the silt is limited to a percentage of the design discharge and shall be fixed on the basis of model tests and silt charge.

7.5 Where an escape is required mainly to empty the channel for maintenance, the capacity should be fixed taking into consideration the number of days in which the canal is to be emptied.

7.6 If none of the above clauses is applicable for fixing the discharging capacity of an escape, the discharging capacity may be kept as up to 1/2 of parent canal.

8 ESCAPE CHANNEL

8.1 When the escape is located near the natural drain bed into which the water is discharged, no escape channel may be required and the difference in elevation may be negotiated through a fall. If the escape channel has to be specially constructed, its bed level and fall should be fixed with reference to that of the drainage into which it outfalls. Where there is substantial difference in the water levels of the canal and escape channel proper energy dissipation arrangements are necessary.

8.2 In case of sluice escapes it is desirable that the bed of escape channel is below the bed level of the canal.

8.3 Grade and section of the escape channel should be such that it may generate non-silting non-scouring velocities and should also be with a stable side slopes.

8.4 The escape channel will usually be either a concrete lined chute or an earthen channel with a series of falls along its course, if found necessary to negotiate the difference in level between the full supply level of the canal and the water level in the natural drainage.

8.5 The capacity of escape channel should be large enough to carry maximum escape discharge.

8.6 The carrying capacity of the natural channel should be investigated taking into consideration the possibility that it may be carrying the natural drainage water at the same time when the escape is opened. If inadequate, the natural channels should be enlarged to carry the required discharge.

8.7 The escape should discharge in a well defined drainage so that problem of water logging may not arise.

9 DESIGN CONSIDERATION FOR ESCAPES

9.1 The difference between the maximum water level of the canal and minimum water level in the escape channel should form the basis for determining the exit gradient, factor of safety against uplift and sliding for designing the escape structure, if the structure is founded on permeable foundation.

9.2 The water way required should be computed using appropriate discharge coefficient depending upon the conditions of flow at the proposed structure.

9.3 In case of surface escapes the sill is provided at full supply level. The waterway should normally be fixed taking into consideration a depth of flow not exceeding 1/2 the freeboard provided in the canal.

9.4 In case of sluice escapes, it is desirable to keep the sill as low as possible depending upon the permissible bed level of the escape channel. This would enable quick emptying silt removing in addition to providing an economical water way.

9.5 Energy dissipation arrangements should be adequate to cater for all conditions of flow and operation.

9.6 Adequate protection works should be provided on the downstrem of the structure as in the case of a regulating structure (*see* IS 6531 : 1992 and IS 4997 : 1968).

9.7 The structural and hydraulic design would be similar to that of regulators or sluices or weir as given in relevant Indian Standard.

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